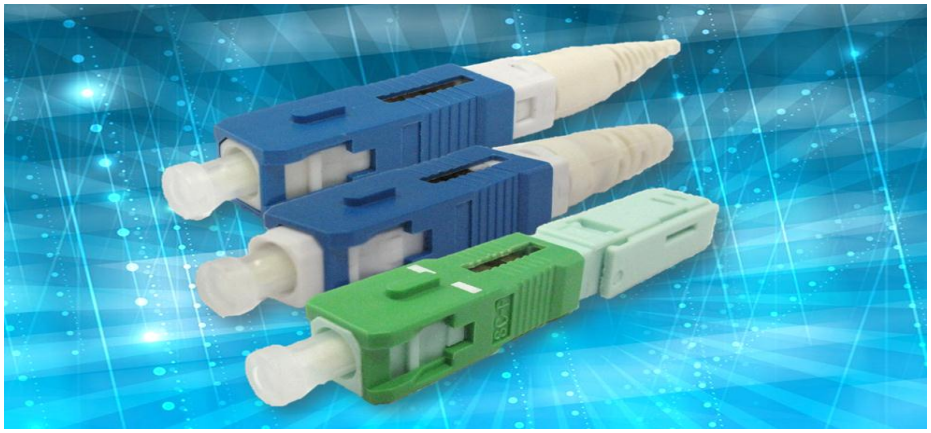
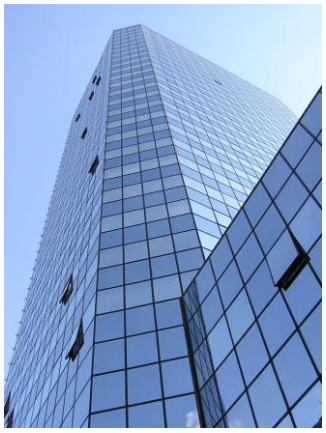
January 2013





SC No Polish Connector

New Product Introduction

OL-MD-10001A

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Outline

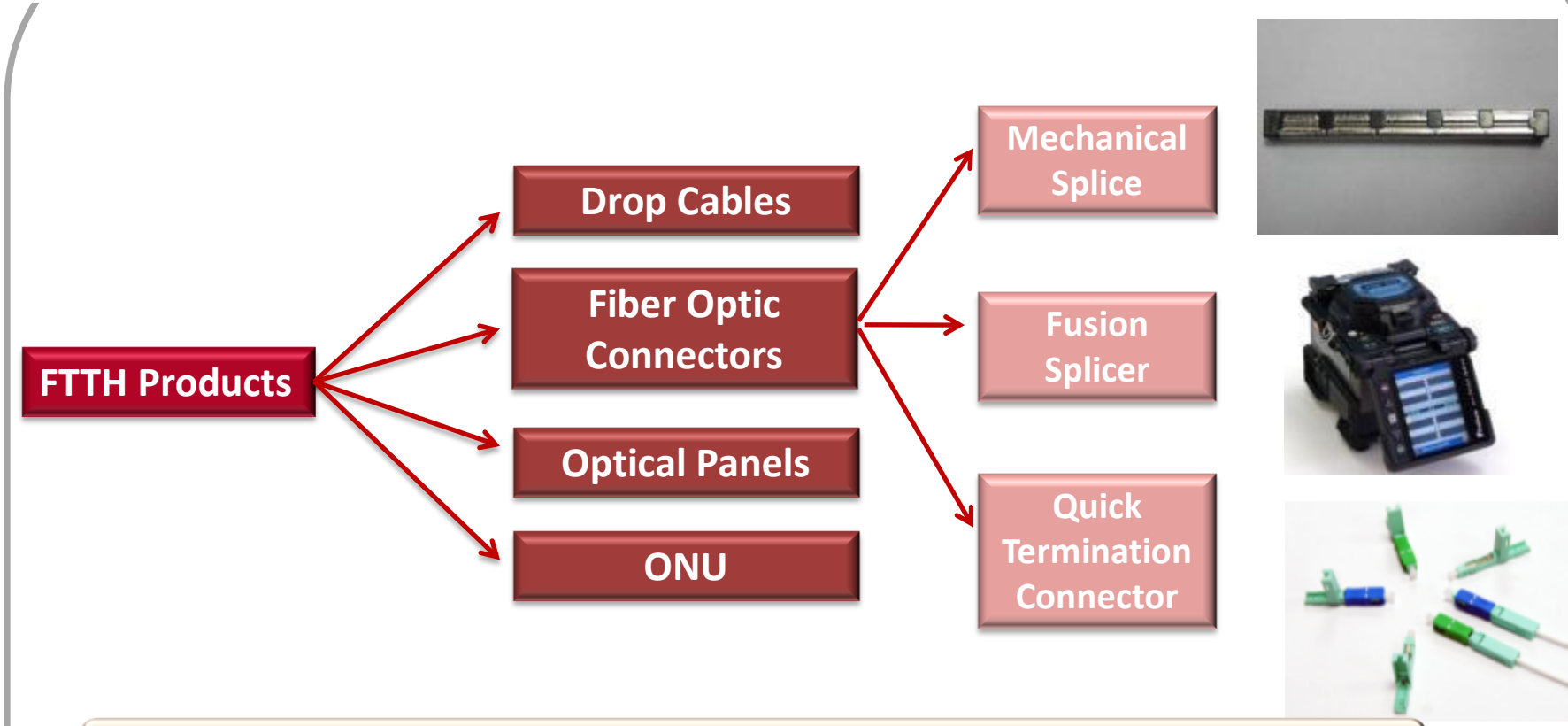
I. Current Situation of FTTH

II. Product Design and Performance

III. Product Strength & Features

IV. Reliability & Test

I. Current Situation of FTTH



IL Comparison between Fusion Splice & Quick-term Connectors

- Max. IL for Fusion Splice = Splice Loss (0.10dB) + Connector Loss (0.35dB) = 0.45dB
- Max. IL for Quick-Term = Interconnection Point (0.15dB) + Connector Loss (0.35dB) = 0.5dB

Advantages & Disadvantages of Fusion Splice

Advantages

- Highly reliable
- Durable
- Special device to detect errors and alert operators

Disadvantages

- Needs electricity or battery for operation
- High operation and maintenance cost
- Needs well-trained operators
- Time consuming

Fusion Splice

Common Quick-Term Connectors

Category

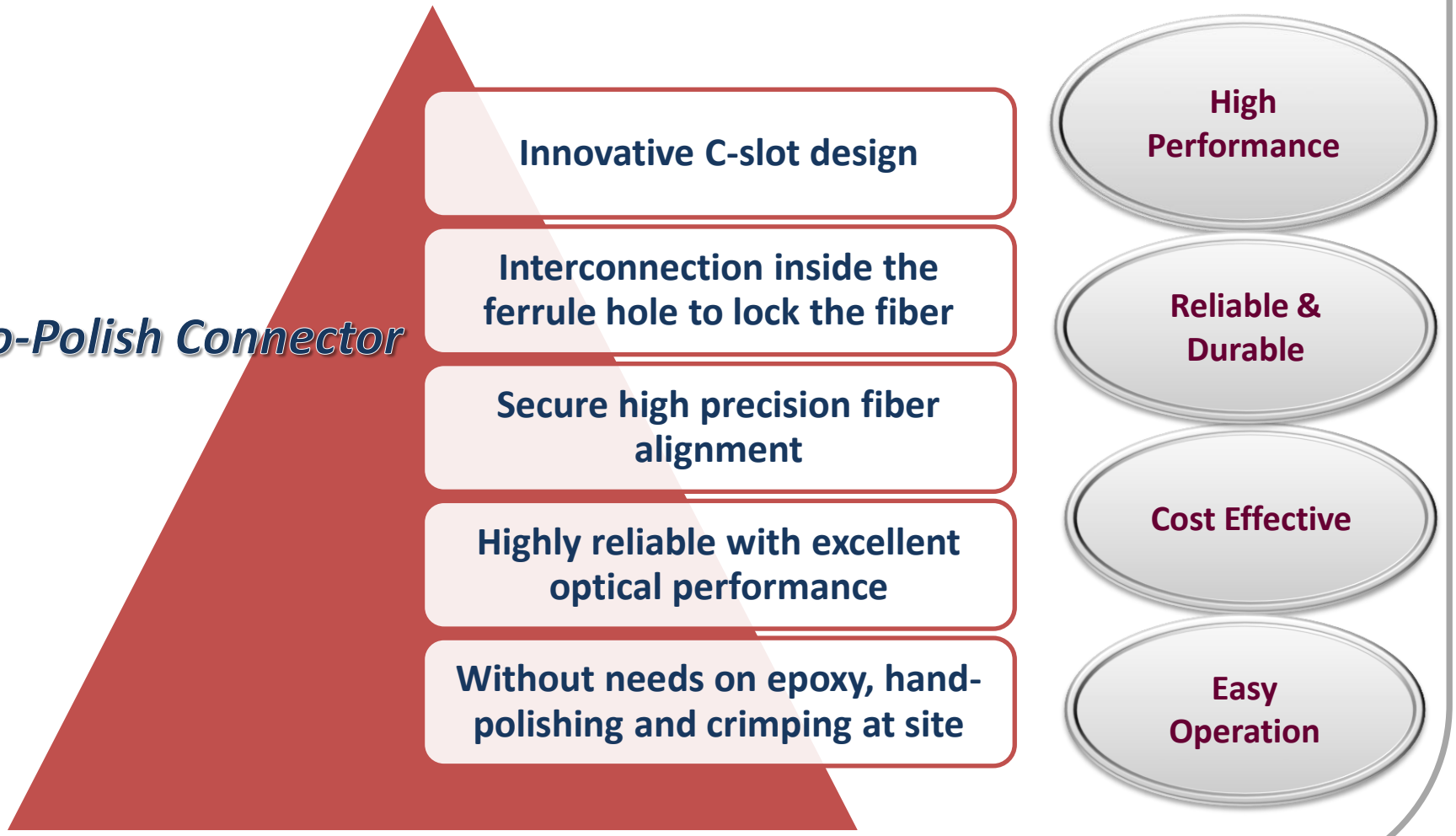
- V-Groove based on PEI or PAR → 
- V-Groove based on Copper or Aluminum Alloy → 
- V-Groove based on Glass → Product Unavailable

Problems

- Intrinsic problem on materials technology and control
- Poor precision molding technology & V-groove deforms
- Poor product design & various constrains on site fields

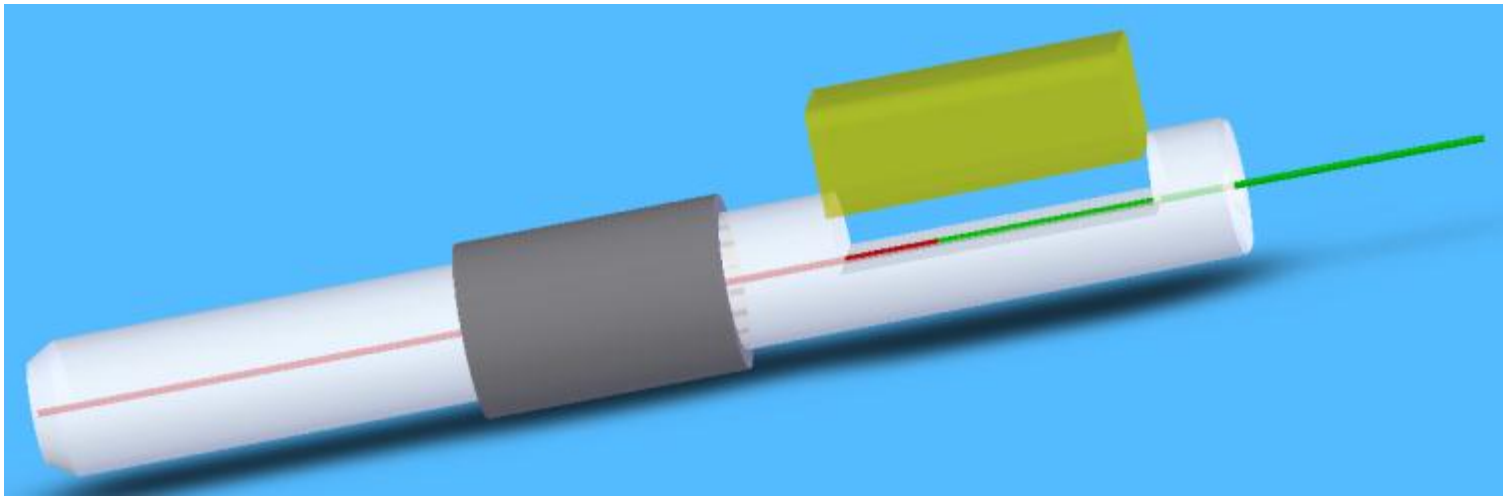
II. Product Design and Performance

- Olabs's SC No Polish Connector resolved all problems



II. Product Design and Performance

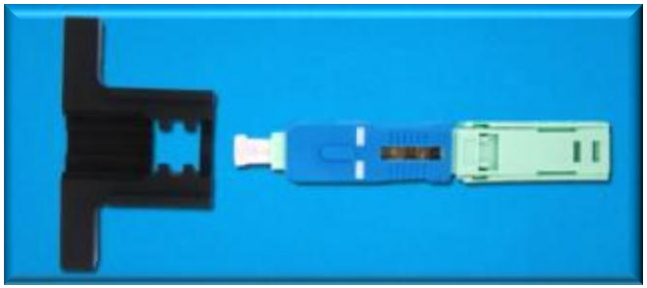
Align and lock the fiber by the step inside ferrule hole, cable to be fixed and clipped at the back

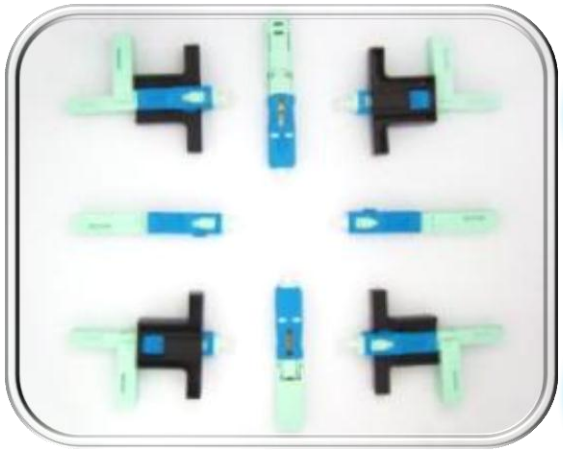


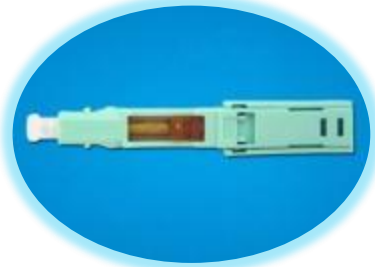
Use the ceramic ferrule hole to hold the embedded fiber and incoming fiber, which ensures the best coaxial and allows the best fibers alignment

II. Product Design and Performance

Product Illustration





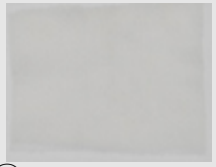


Parts & Components

① Connector main body

② Cable clamp

③ Fiber cleave holder



④ Cleaning tissue

Tools Needed

① Fiber stripper

② Drop-cable jacket stripper

③ Fiber cleaver

II. Product Design and Performance

Specifications	
Connector Type	SC Singlemode
Ferrule Type	Ceramic
Cable Type	Drop Cable
Operating Temperature	-40°C ~ +85°C
Mechanical Performance	Straight pulling force 30N *
Mating Durability	< 0.1dB after 500 mating
Insertion Loss	Typical 0.15 dB Maximum 0.40 dB
Return Loss	55dB

C-Slot replace V-Groove --- Patent Design

Fundamental problems with conventional options：

1. Deforming V-groove lead to bad fiber connection
2. Thermal expansion and contraction lead to unstable performance in temperature change, and unsustainable in extreme temperature -40˚C ~ +85˚C
3. Low rigidity of plastic, lead to V-Groove deformation or deterioration
4. Easily deform or rust for plastic or metal materials, lead to bad connection

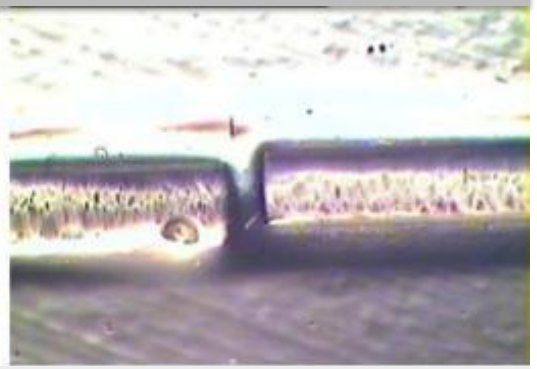
III. Product Strength & Features

Interconnection inside the ferrule hole – High precision (Patent Design)

- One of the greatest challenges is to tackle the material extraction caused by extreme high temperature (several hundred degrees) during molding formation.
- The V-Groove technology requires the deviation of fiber alignment less than 1μm, that implies the V-Groove precision has to be controlled in < 1μm, it is extremely difficult to achieve.

Below pictures shows v-groove condition under a 200x microscope.



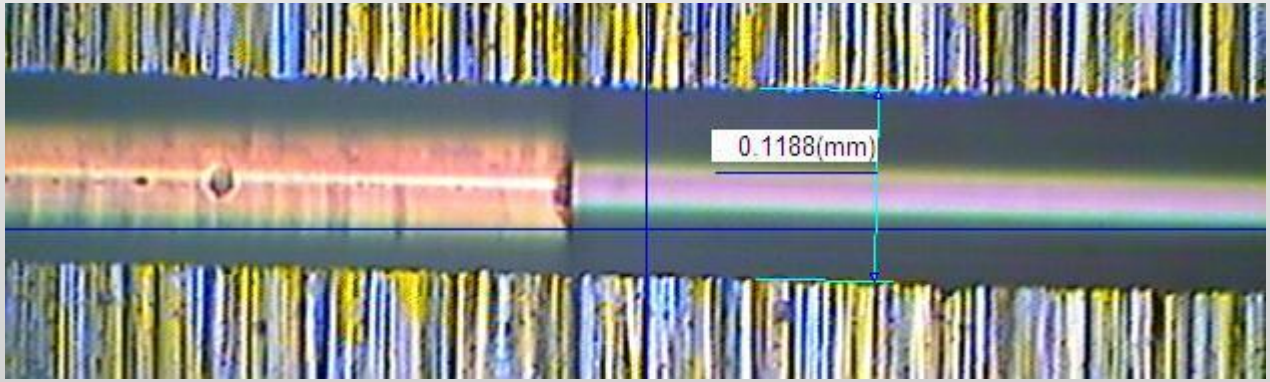


From the pictures, we could see clearly that v-groove deforms obviously, which lead to fiber mis-alignment and will create high optical loss.

III. Product Strength & Features

Interconnection inside the ferrule hole – High precision (Patent Design)

- Below pictures shows C-slot condition under a 200x microscope, we could see clearly that two fibers are aligned in the ferrule coaxially.



- Normally, the ID of ferrule is 1μm larger than fiber OD.
- By adapting special material to tighten the contact of 2 fibers inside the ferrule, a higher precision of fiber alignment could be further secured.

III. Product Strength & Features

Ceramic delivers excellent compatibility and low thermal expansion coefficient

- Ceramic material assures minimal change of insertion loss value under extreme temperature change.
- Under the temperature cycle test of -40 ˚C ~ +85 ˚C, change of insertion loss is only Δ IL < 0.1dB.
- Although most of the other products are able to sustains Δ IL @ 0.3dB during high-low temperature change, it is difficult to guarantee the stability during gradual aging process.
- The table below shows the coefficient for optical performance during temperature change by comparing ceramic and plastic material.

Material	Coefficient of Thermal Expansion	Presumed Locking Distance	Installation Temperature	Operation Temperature	Distance between Two Fibers	Operation Loss
Ceramic	10×10^-6	8mm	-10°C	50°C	4um	0.005dB
Plastic	50×10^6	8mm	-10°C	50°C	20um	0.124dB

III. Product Strength & Features

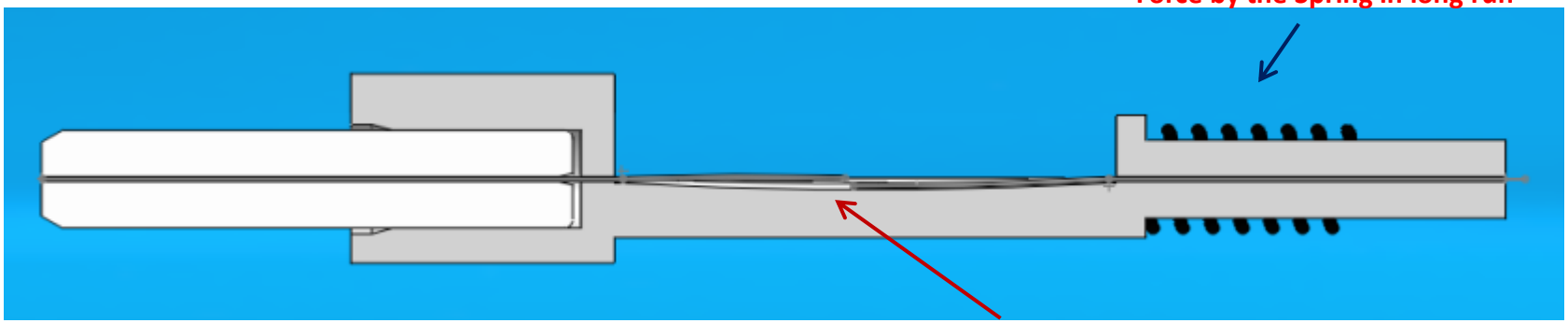
Ceramic has distinctive rigidity -- Non-deformed interconnection point

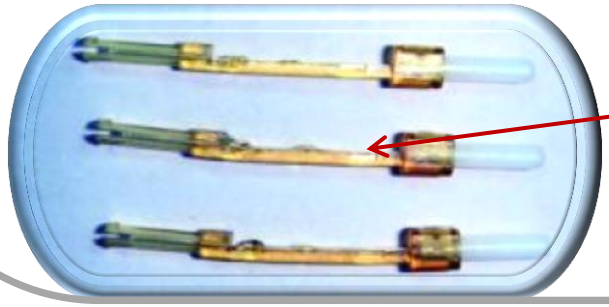
- For V-groove plastic ferrule, fiber is locked and forced by unnecessary pressure, which causes deformation of fiber in long run.
- Ceramic ferrule can provide superior bending strength than those of plastic ferrules.
- The innovative C-slot design on ceramic ferrule allows fiber interconnection inside the ferrule hole without giving unnecessary pressure.
- Thus, assure the interconnection point is non-deformed.

III. Product Strength & Features

C-Slot design ensure Non-deformation

- Most of the plastic ferrule's V-Groove design uses a spring at the back to push forward the incoming fiber & to make the fibers be tightly connected.
- It causes extra pressure at the bottom part of the plastic V-groove, in long run, the V-Groove will deform unavoidably.
- Our innovative C-Slot ceramic ferrule avoid this problem.





III. Product Strength & Features

Longer durability with good performance

- Ceramic ferrule is the key to guarantee longer product life.
- Ceramic ferrules passed the high pressure temperature test and temperature cycle test of -85˚C ~ +85˚C, ensure superior surface roughness, aging resistance, fulfill excellent inner and outer finishing, flatness and precision for interconnection.

Easy handling for field termination with high yield rate

- Extremely user-friendly design cater for field termination.
- Provides tailor-made fiber cleaving “Positioning Gasket” to ensure appropriate fiber cleaving length.
- C-Slot inner core insides ferrule facilitates easy fiber thread-through.
- Enhance installation efficiency and to achieve excellent yield rate.

1. Overall Test Results

Types of Testing	3rd Party Test		Internal Test	
	Nos. of Sample	Testing Cycle（Month）	Nos. of Sample	Testing Cycle（Month）
Test 1 -- Insertion Loss -- Return Loss -- Average Assembly Time -- One-time Success Rate	40	24	100	6
Test 2 -- Repeatability -- Low Temperature	6	24	12	6
Test 3 -- High-low Temperature Cycle -- Vibration（Sine） -- Drop Test	6	24	12	6
Test 4 -- High Temperature -- Mechanical Durability	6	24	12	6
Test 5 -- Hot & Humidity -- Tension -- Torsion（for cable）	6	24	12	6
Test 6 -- Ingress Protection	4	24	12	6
Test 7 -- Assembly Repeatability	4	24	12	6

2. Result of Particular Test (a)

High-Low Temperature Cycle Test

Conditions :

- Max High Temperature : Ta = +85 ˚C
- Max Low Temperature : Tb = -40 ˚C
- Cycles : 21 cycles (8hrs/cycle), 168 hrs in total

Requirements :

- IR : ≤0.3dB, RL : ≤5dB

Results :

- IR : ≤0.05dB, RL : ≤1.5dB
- No mechanical damage, deformation cracking or relaxing

Online Test Result :

- IL : ≤2dB, RL : ≤0.1dB

2. Result of Particular Test (b)

Low Temperature Test

Conditions :

- Temperature : -40 ˚C
- Duration : 96h

Requirements :

- IL : ≤0.3dB, RL : ≤5dB

Results :

- IL : ≤0.04dB, RL : ≤1.7dB
- No mechanical damage, deformation cracking or relaxing

Online Test Result :

- IL : ≤0.1dB, RL : ≤2dB

2. Result of Particular Test (c)

Vibration Test (Sine)

Conditions :

- Frequency Range : 10-50Hz
- Sweep frequency : 45 times/mins
- Amplitude : 0.75mm single amplitude
- Duration and Direction： 3 directions, 2 hour for each

Requirements :

- IL : ≤0.3dB, RL : ≤5dB

Results :

- IL : ≤0.05dB, RL : ≤1.3dB
- No mechanical damage, No obvious scratches on ferrules surface

2. Result of Particular Test (d)

Drop Test

Conditions :

- Height : 1.5m above samples head
- Times：8 times

Requirement :

- IL：≤0.3dB, RL：≤5dB

Results :

- IL：≤0.06dB, RL：≤1.2dB
- No mechanical damage, deformation cracking or relaxing

2. Result of Particular Test (e)

High Temperature Test

Conditions :

- Temperature : +85 ˚C
- Duration : 96h

Requirements :

- IL : ≤0.3dB, RL : ≤5dB

Results :

- IL : ≤0.07dB, RL : ≤2.5dB
- No mechanical damage, deformation cracking or relaxing

Online Test Result :

- IL : ≤0.1dB, RL : ≤3dB

2. Result of Particular Test (f)

Humidity and Hot Test

Conditions :

- Temperature : +75 °C
- Humidity Rate : 95%
- Duration : 96h

Requirements :

- IL : ≤0.3dB, RL : ≤5dB

Results :

- IL : ≤0.05dB, RL : ≤1.7dB
- No mechanical damage, deformation cracking or relaxing

Online Test Result :

- IL : ≤0.1dB, RL : ≤2dB

2. Result of Particular Test (g)

Tension Test

Conditions :

- Load : 20N (online test), 30N (offline test)
- Duration : 2 mins
- Distance : 22-28 cm

Requirements :

- IL : ≤0.3dB, RL : ≤5dB

Results :

- IL : ≤0.03dB, RL : ≤0.7dB
- No mechanical damage, deformation cracking or relaxing

Online Test Result :

- IL : ≤0.03dB, RL : ≤0.7dB

2. Result of Particular Test (h)

Torsion Test

Conditions :

- Load : 15N
- Distance : 22-28 cm
- Times : 200 times
- Pulling Frequency : 10 times/ mins

Requirements :

- IL : ≤0.3dB, RL : ≤5dB

Results :

- IL : ≤0.02dB, RL : ≤0.4dB
- No mechanical damage, deformation cracking or relaxing

2. Result of Particular Test (i)

Ingress Protection Test

Conditions:

- Container Environments:
  25+2˚C running water
- Duration : 168 hrs

Requirements:

- IL : ≤0.3dB, RL : ≤5dB

Results:

- IL : ≤0.09dB, RL : ≤1.4dB
- No mechanical damage, deformation cracking or relaxing